I AM A WOMAN BUT NOT THIS KIND OF WOMAN:

BIFURCATION IN GENDER IDENTITY IN

RESPONSE TO STEREOTYPE THREAT

by

Dominika Mazur

A dissertation submitted to the faculty of
The University of Utah
in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Psychology

The University of Utah

May 2014

The University of Utah Graduate School

STATEMENT OF DISSERTATION APPROVAL

The following faculty members served as the supervisory committee chair and members for the thesis of Dominika Mazur

Dates at right indicate the members' approval of the thesis.

_____ Paul H. White_____, Chair	_12/02/13_____ Date Approved
_____ Bert N. Uchino _____, Member	_12/02/13_____ Date Approved
_____David M. Sanbonmatsu_____, Member	_12/02/13_____ Date Approved
_____Jason Watson_____, Member	__12/02/13_____ Date Approved
_____Thomas N. Maloney _____, Member	__12/02/13_____ Date Approved

The thesis has also been approved by _____Carol Sansone__,Chair of the Department/School/College of _____Psychology_____

and by David B. Kieda, Dean of The Graduate School.

ABSTRACT

The goal of this research was to investigate the effects of selective changes in feminine identity (identity bifurcation) on self-concept, cognitive functioning, and math performance of women. Study 1 showed that women highly identified with math had a tendency not to identify with stereotypically feminine characteristics that are deemed incompatible with being successful in quantitative domains (e.g., being emotional, flirtatious). At the same time, these women identified with feminine characteristics that are perceived as not incompatible with women's success in quantitative domains (e.g., being intuitive, empathic, or fashionable). In Study 2 female participants were exposed to stereotype threat and given an opportunity to use identity bifurcation as an ego-protective strategy. Subsequently, participants' self-esteem, working memory capacity, math performance, and self-integrity were measured. As predicted, stereotype threat negatively affected women's math performance. However, the link between stereotype threat and math performance found in the current study was not a direct causal path, but it occurred through self-integrity and working memory acting as serial mediators. Women who were exposed to stereotype threat reported lower feelings of self-integrity, which, in turn negatively impacted their working memory capacity and undermined their math performance. Study 2 results also demonstrated that women responded to stereotype threat with bifurcation in their feminine identity. However, this change in identity did not

have an effect on working memory and math performance through positively affecting self-concept. Theoretical and practical implications of these results are discussed.

TABLE OF CONTENTS

INTRODUCTION

Negative performance stereotypes, such as the one that women are not good at math, can undermine positive feelings about self and cause performance decrements in the domain related to the stereotype; a concept called stereotype threat (e.g., Martens, Johns, Greenberg, & Schimel, 2006; Nosek et al., 2009; Schmader, Johns, & Forbes, 2008; Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995). In these circumstances, people may use various ego-defensive strategies to deal with unpleasant feelings that arise from concerns of being evaluated based on stereotypes (e.g., Ambady, Paik, Steele, Owen-Smith, & Mitchell, 2004; Crocker, Major, & Steele, 1998; Rydell & Boucher, 2010). For example, Eileen Pollack, a novelist and creative writing professor, became one of the first two women to obtain a bachelor of science degree in physics in the history of Yale University. In an essay on women in science, she described a strategy that initially worked for her, but eventually was one of the factors that made her leave the field: "I was tired of dressing one way to be taken seriously as a scientist while dressing another to feel feminine" (Pollack, 2013, p. 1). In the same essay, Meg Urry, former chair of Physics at Yale and president-elect of the American Astronomical Society, discussed that this "dual life" idea may be part of the culture of science in America by stating, "American men can't seem to appreciate a woman as a woman *and* as a scientist; it's one or the other" (Pollack, 2013, p. 3).

The strategy described in Pollack's essay may be connected to the concept of identity bifurcation (e.g., Pronin, Steele, & Ross, 2004). Identity bifurcation occurs when people lower their self-identification with the stigmatized group's characteristics and activities that are related to the negative stereotype while maintaining identification with the group's features not associated with the stereotype, as well as their global identification with the stigmatized group. Pronin et al. (2004) suggested identity bifurcation as an ego-protective strategy that people may use when threatened by a stereotype. However, little research has been devoted to investigating how bifurcation in identity affects one's overall self-concept and whether it can alleviate the negative effects of stereotype threat and help the actual performance in the stereotyped domain.

Thus, the goal of the current research was to investigate the ego-defensive properties of identity bifurcation and look at whether identity bifurcation could enhance self-esteem and self-integrity and lower self-doubt about ability under stereotype threat. In addition, this research intended to test whether identity bifurcation protects working memory resources and performance in a stereotype relevant domain through these ego-defensive properties.

Stereotype Threat and Self-integrity

Stereotype threat research suggests that members of stigmatized groups underperform in the domains in which they are stereotyped as doing poorly, in part because of a concern that their performance might confirm negative stereotypes about their group (for a review, see Steele, Spencer, & Aronson, 2002). Unfortunately, attempts to disconfirm the stereotypes may contribute to poor performance on the task resulting in the confirmation of the actual stereotype (e.g., Davies, Spencer, Quinn, & Gerhardstein,

2002; Spencer et al., 1999). One of the explanations for this phenomenon is that negative stereotypes pose a threat to people's sense of self-integrity (Schmader et al., 2008), which is defined as the need to perceive oneself in a positive way, as being consistent and worthy, having free choice, and having the ability to control one's performance outcomes (e.g., Steele, 1988; Swann, 1987; Taylor & Brown, 1988). People may perceive stereotypes as a threat to self-integrity because the negative information contained in the stereotype challenges their positive and consistent self-view (e.g., Rydell & Boucher, 2010; Rydell, McConnell, & Beilock, 2009; Schmader et al., 2008).

One outcome of this self-integrity challenge is that people may experience working memory deficits due to not focusing fully on the task at hand and being preoccupied with negative thoughts (e.g., Cadinu, Maass, Rosabianca, & Kiesner, 2005), and expending cognitive resources to restore their self-integrity (Schmader et al., 2008). Working memory is involved in such complex operations as comprehension, reasoning and problem solving (Conway et al., 2005). Therefore, extra cognitive load that is unrelated to the task at hand drains working memory capacity, resulting in underperformance on this task (e.g., Beilock, Kulp, Holt, & Carr, 2004; Beilock, Rydell, & McConnell, 2007; Schmader & Johns, 2003; Schmader et al., 2008).

Ego-protective Strategies in Response to Stereotype Threat

People may use different ego-defensive strategies in order to protect their self-integrity when they experience stereotype threat. For example, African Americans, who are stereotyped as doing poorly at school compared to other ethnic groups, may disengage their self-esteem from their academic results (e.g., Major, Spencer, Schmader, Wolfe, & Crocker, 1998; Steele, 1997). Similarly, women tend to have lower

identification with mathematics and related fields due, in part, to being stereotyped as doing poorly in math compared to men (e.g., Mazur, 2011; Smith, Morgan, & White, 2005; Smith & White, 2001; Steele, 1997).

Another strategy is disidentification not with the domain, but with the stigmatized ingroup (Tajfel & Turner, 1986). When members of stigmatized groups lower their identification with the negative ingroup, stereotypes about this group become less relevant to them and stereotype threat does not affect them as much (e.g., Schmader, 2002). Disidentification with stigmatized ingroup occurs in different ways. For example, research on individuation shows that having members of stigmatized groups focus on their individual rather than group characteristics when they are in a stereotype threat situation can reduce stereotype threat due to the negative stereotypes being less salient to the sense of self (e.g., Ambady et al., 2004; Turner & Onorato, 1999). Furthermore, members of stigmatized groups can decrease the stigmatized group identity salience by strengthening identification with different, more positive groups to which they also belong (e.g., Rydell & Boucher, 2010; Rydell et al., 2009; Shih, Pittinsky, & Ambady, 1999).

All of these strategies can be in the service to protect ones' self-worth and self-esteem (e.g., Crocker & Major, 1989; Crocker et al., 1998; Crocker & Wolfe, 2001; Major et al., 1998). However, while these ego-defensive strategies halt or alleviate stereotype threat, they may have negative side effects. In the case of disidentification with the domain, performance may suffer due to decreased investment, motivation, and interest in the domain (Major et al., 1998; Steele, 1997). For group identification, these techniques over time may push people into a group membership that is not acceptable (cf.

Fordham & Ogbu, 1986; Ogbu, 2004). In addition, members of stigmatized groups who do not strongly identify with the ingroup may experience higher levels of social identity threat, which in turn may lower their self-esteem (e.g., Ethier & Deaux, 1994). In contrast, those who maintain high identification with the stigmatized group provide for and benefit from the social support of other ingroup members and maintain high self-esteem, which can protect them from the negative effects of discrimination (e.g., Branscombe, Schmitt, & Harvey, 1999; Crabtree, Haslam, Postmes, & Haslam, 2010; Haslam, O'Brien, Jetten, Vormedal, & Penna, 2005; Rowley, Sellers, Chavous, & Smith, 1998).

Identity Bifurcation

As previously mentioned, identity bifurcation is another possible ego-protective strategy (Pronin et al., 2004). Identity bifurcation is a process in which instead of disidentifying with the stigmatized ingroup in general, people are selective in this process such that they disidentify only with the ingroup characteristics that are associated with the negative stereotype while maintaining identification with ingroup characteristics that are not related to that stereotype. Thus, one can identify with the domain and still be connected with the stigmatized group overall. In two studies, Pronin et al. (2004) found that women in whom stereotype threat was activated showed less self-identification with feminine characteristics that were deemed not compatible with success in quantitative domains (e.g., acting emotional or flirtatious when you are a math major) compared to women who were not under threat. At the same time, both groups maintained global self-identification with women as a social group and identified with the feminine

characteristics that were not linked to poor performance in quantitative domains (e.g., being sensitive or fashionable).

Some ego-protective strategies are believed to help performance because they restore self-integrity after an ego-related threat and free up the working memory resources that would be used to cope with the threat in the situation (e.g., Rydell et al., 2009; Schmader et al., 2008). Currently, we do not know if identity bifurcation has similar properties. Finally, questions remain about how exactly identity bifurcation affects people's self-concept. Can this selective change in feminine identity be a stable part of self-concept or is it more strategic and context specific? We also do not know if this strategy affects self-esteem and self-doubt about ability in a stereotype threat situation. The current research attempted to answer these questions in three studies.

PRELIMINARY STUDY

The goal of this study was to operationalize identity bifurcation. According to Pronin et al. (2004), the following characteristics were viewed as feminine traits and activities that were not compatible with women's success in quantitative fields: *wearing make-up*; *being flirtatious*, *gossipy*, *emotional*, or *artistic*; *wanting children;* and *planning to spend time away from work to raise children*. A woman who possesses these traits is at high risk of being negatively judged in quantitative domains. In contrast, *being fashionable*, *nurturing*, *empathetic*, *sensitive,* and *shy* were feminine characteristics that did not put women at risk of being negatively judged in quantitative domains. Bifurcation in identity was defined as self-identification with the characteristics that were low risk while disidentifying with the characteristics that were high risk.

The first step was to validate that the twelve characteristics identified by Pronin et al. (2004) were categorized similarly by students at the university where the current research was conducted. I also selected 36 additional personality traits from Rothbart and Park (1986) to identify other characteristics that could be high or low in stereotype relevance and to find characteristics that were rated as highly masculine. I wanted to identify masculine characteristics to test the possibility that women in subsequent studies may self-identify with masculine traits to cope with stereotype threat. In addition, I aimed to identify several gender neutral characteristics to be used as fillers.

Method

Participants and Procedures

Participants were 45 female psychology undergraduates[1] from a large state university in the Rocky Mountain region, (*Mean age* = 24, *SD* = 4.44). They completed an online survey in which they were asked to rate 48 characteristics using two dimensions. Participants rated each item in terms of how much they thought the characteristic was feminine vs. masculine (question *How feminine vs. masculine is this characteristic?*) on a 7-point scale (1 = very feminine, 7 = very masculine). Next, they rated each item on the question, *Rate how much you think this characteristic would put a woman at risk for being negatively judged in quantitatively based fields and/or careers (e.g., math, engineering, computer science)* on a 7-point scale (1 = low risk, 7 = high risk).

Results and Discussion

Selection and Categorization of Characteristics

Characteristics that had average ratings across participants below the midpoint on the 7-point scale for the gender question were categorized as feminine. Characteristics were categorized as masculine when they had average ratings above the midpoint on this question. Characteristics that received midpoint average ratings across participants on this question were categorized as gender neutral.

Only the feminine characteristics were used to create the stereotype-relevant and stereotype-not-relevant subsets. Characteristics that received mean ratings above the

[1] Three participants were removed from the analyses because they did not provide answers to 37% or more items in their survey. An additional six participants were not included in the analyses because they indicated that they were international students, and I did not want cultural and language differences to influence the results.

midpoint on a 7-point scale for the risk question were categorized as stereotype-relevant and not compatible with women's success in quantitative fields. Characteristics that received mean ratings below the midpoint were categorized as stereotype-not-relevant, which means that possessing those characteristics would not put a woman at risk for being negatively judged in quantitatively based fields and/or careers.

The list of characteristics identified as stereotype-relevant and stereotype-not-relevant in the current research differed from the list used by Pronin et al. (2004; see Table 1 for the full list of characteristics used in the current research). The following characteristics from Pronin et al. (2004) were not included in the current research because they did not fulfill the selection criteria: stereotype-relevant: *gossipy, having children, leaving work to raise children*; stereotype-not-relevant: *sensitive, nurturing*; masculine: *analytical, playing sports, adventurous*. One characteristic (*wearing makeup*) switched from stereotype-relevant to stereotype-not-relevant.

Difference in Risk Ratings between Subsets

Risk ratings averaged within each subset exhibited satisfactory reliability: stereotype-relevant (Cronbach α = .67), stereotype-not-relevant (Cronbach α = .64), masculine (Cronbach α = .78), and gender-neutral filler (Cronbach α = .54). Therefore, the subsets were subject to a repeated measures analysis of variance (ANOVA) to test if they significantly differed from each other. The analyses revealed significant differences, $F(3, 40) = 74.23$, $p < .0001$, $\eta_p^2 = .848$. Post hoc analyses using LSD adjustment revealed that all four sets significantly differed from each other, $p's < .0001$. The stereotype-relevant characteristics set had significantly higher average risk ratings, and the filler

characteristics set had the lowest mean ratings (see Table 1 for means and standard deviations).

Characteristics Questionnaire

The results of this study helped to create the Characteristics Questionnaire, which is the measure that is utilized to operationalize and evaluate the magnitude of identity bifurcation in the subsequent studies. The questionnaire included 20 different personality traits with four subsets: stereotype-relevant, stereotype-not-relevant, masculine, and gender-neutral filler and was described to participants as a standard personality survey. Participants first rated how much each characteristic applies to them (1 = not at all, 7 = very much), and then indicated on the same scale how important having this characteristic is to their sense of self. Next, these two responses were aggregated and averaged to obtain a single mean rating of the extent to which a person self-identifies with a given characteristic (Pronin et al., 2004). Next, the ratings were averaged among characteristics within each subset to create three indices of self-identification with stereotype-relevant, stereotype-not-relevant, and masculine characteristics.

Operationalization of Identity Bifurcation in Current Research

Pronin et al. (2004) defined identity bifurcation as embracing feminine characteristics that are not associated with the negative stereotype and disidentification with the characteristics that are related to the negative stereotype. To operationalize it in their studies, they analyzed participants' self-identification with stereotype-relevant and stereotype-not-relevant characteristics subsets in separate statistical tests (i.e., without looking at how the two subsets related to each other). However, in the current research, I attempted to operationalize identity bifurcation in a way that is more consistent with a

Table 1. Characteristics used in the current research to operationalize identity bifurcation

	"Rate how much you think this characteristic would put a woman at risk for being negatively judged in quantitatively based fields and/or careers (e.g., math, engineering, computer science)", 1 = low risk, 7 = high risk	
Characteristics	*M*	*SD*
Stereotype-relevant set		
Flirtatious [a]	4.93	1.40
Emotional [a]	4.84	1.82
Chatty [c]	4.51	1.67
Sensual [c]	4.44	1.91
Playful [c]	4.13	1.67
Set average rating	**4.52**[d]	**1.11**
Stereotype-not-relevant set		
Fashionable [a]	3.29	1.75
Wear Makeup [ab]	3.02	1.91
Empathetic [a]	2.41	1.37
Intuitive [c]	2.02	1.44
Detail-oriented [c]	1.68	1.29
Set average rating	**2.49**[f]	**0.99**
Masculine characteristics set		
Confrontational [c]	5.09	1.53
Aggressive [a]	4.53	1.63
Assertive [a]	3.38	1.81
Competitive [a]	3.16	1.83
Independent [c]	2.31	1.70
Set average rating	**3.75**[g]	**1.24**
Filler characteristics set		
Determined [c]	2.11	1.54
Cooperative [c]	1.91	1.44
Musical [c]	1.69	1.18
Creative [c]	1.86	1.40
Set average rating	**1.91**[h]	**0.91**

Note. Set average ratings with the same superscript letters are not statistically different from each other ($p > .05$).

[a] Characteristic from the original list created by Pronin et al. (2004).

[b] Characteristic was in the stereotype-relevant set in Pronin et al. (2004) and was moved to the stereotype not-relevant set in the current research.

[c] Characteristic that was selected in current research but did not appear in Pronin et al. (2004).

common definition of bifurcation in science (e.g., Kelso, 1995).

Bifurcation is defined as the division of something that used to be a unity into at least two parts. In contrast, lack of bifurcation is when the two parts are united. Therefore, to better reflect bifurcation as well as lack of bifurcation, I created a single relative index that is a difference between stereotype-relevant and stereotype-not-relevant set scores (stereotype-relevant set subtracted from stereotype-not-relevant set). Scores close to zero on this index indicate a lack of identity bifurcation (equal identification with stereotype-relevant and stereotype-not-relevant traits). Negative scores (-1 to -7) indicate identity bifurcation in the direction of high self-identification with stereotype-relevant characteristics and low self-identification with stereotype-not-relevant characteristics. Positive scores (1 to 7) on this index indicate identity bifurcation in the direction of low self-identification with stereotype-relevant characteristics and high identification with stereotype-not-relevant characteristics. Another advantage of this approach is that combining the two ratings into one difference score yields more statistical power because it reduces variance compared to when the scores on two subsets are analyzed in separate statistical tests. This relative index along with the operationalization by Pronin et al. (2004) will be used in subsequent studies to assess the level of bifurcation in feminine identity.

STUDY 1

The goal of Study 1 was to test the relationship between identification with the stigmatized domain and identity bifurcation. Based on Pronin et al. (2004), investment in math (e.g., number of math classes taken in college, math skills being important to self) affects levels of identity bifurcation. Women who are invested in math may show greater identity bifurcation compared to women not invested in math for two reasons: a) they take more math classes, so there is more opportunity for them to become an object of stereotyping and b) they are more sensitive to stereotype threat because their self-worth is contingent on their performance, investment, and identification with math (Aronson et al., 1999; Crocker et al., 1998; Steele, 1997; Steele & Aronson, 1995). Therefore, these women may often use identity bifurcation as a coping technique to the point that it becomes a stable part of their self-concept. This means they would disidentify with stereotype-relevant feminine characteristics, regardless of whether they currently experienced acute stereotype threat or not (Pronin et al., 2004). Alternatively, identity bifurcation may be a context-specific ego-protective strategy that only occurs in the presence of stereotype threat.

Method

Participants, Design and Procedures

Participants in this study were 404 female students (*Mean age* = 22, *SD* = 5.46) enrolled in an introductory psychology class at a large state university in the Rocky

Mountain region. Participants completed the Characteristics Questionnaire to assess level of identity bifurcation, along with the Domain Identification Measure (DIM), which assesses the importance of a domain (in this instance, mathematics) for participants' sense of self (Smith & White, 2001). The DIM consists of nine items answered on a 5-point scale (1 = not at all, 5 = very much). Both questionnaires were included in a packet of psychology measures and administered online during an introductory psychology mass testing session in the Spring 2013 and Fall 2013 semesters. None of the other items in the mass testing sessions evaluated actual math performance or asked about academic performance; therefore, I assume that participants did not experience math stereotype threat during the current study. Students completed IRB consent forms prior to participating and were given research credit for their participation.

Results and Discussion

The first set of analyses employed the Pronin et al. (2004) operationalization of identity bifurcation. DIM responses were aggregated into one score (Cronbach α = .90) and entered into a regression analysis as the predictor. Self-identification with stereotype-relevant characteristics was entered as the outcome (Cronbach α = .70). This analysis revealed no significant effect of domain identification, $F(1, 390) = 0.82$, $p = .365$. The same regression analysis was performed with self-identification with stereotype-not-relevant characteristics entered as the outcome (Cronbach α = .44), and it revealed no significant effect of domain identification, $F(1, 398) = 0.94$, $p = .333$. In conclusion, bifurcation in feminine identity examined by looking at self-identification with stereotype-relevant and stereotype-not-relevant characteristics in separate analyses was not predicted by domain identification.

Next, regression with DIM scores entered as the predictor and identity bifurcation relative index entered as the outcome indicated a marginally significant effect of domain identification, $F(1, 389) = 2.92$, $p = .088$. High identification with the domain of mathematics predicted high levels of identity bifurcation in the direction of disidentification with stereotype-relevant characteristics and identification with stereotype-not-relevant characteristics, $B = .01$, $t(389) = 1.71$, $p = .088$, semipartial $r^2 = .007$.

In sum, results showed that women highly identified with math had a tendency to disidentify with stereotype-relevant characteristics and identify with stereotype-not-relevant characteristics even when they were not in a stereotype threat situation. However, this effect was found only with identity bifurcation relative index. The effect is small and marginally significant, but does lend support that women who care about a stigmatized domain engage in identity bifurcation chronically (e.g., Pronin et al, 2004). It is possible that this effect is stronger in an actual stereotype threat situation, which would support the idea that people use identity bifurcation strategically to cope with the immediate negative effects of stereotyping. Therefore, this relationship between identity bifurcation and investment in mathematics will be tested again in Study 2 in which stereotype threat was experimentally manipulated.

STUDY 2

The goal of Study 2 was to replicate finding by Pronin et al. (2004) showing that women respond to stereotype threat with identity bifurcation and extend those results. If identity bifurcation is an ego-protective strategy used in the face of stereotype threat, then it should shield self-concept (i.e., self-integrity, self-esteem) from the negative impact of stereotype threat. In addition, women may experience less self-doubt about their ability in the performance situation if they disidentify with the feminine characteristics associated with stereotypes relevant to the domain. If women dissociate from these negative characteristics, then the stereotype should not apply to them and their performance in this domain.

Lastly, if stereotype threat diminishes working memory and performance because people under threat use their cognitive resources to restore a positive and consistent self-view, then identity bifurcation should free up working memory resources typically used to repair the self-concept because bifurcation would protect or buffer the self-concept from the stereotype threat.

In sum, identity bifurcation is predicted to increase in women who experience stereotype threat. Increased identity bifurcation could have a positive effect on self-esteem and self-integrity and reduce feelings of self-doubt in a performance situation. These positive outcomes could in turn improve working memory capacity, which would lead to better performance in the stereotyped domain.

I also predict that investment in mathematics and self-esteem can have an effect on stereotype threat and identity bifurcation. Study 1 results and previous research by Pronin et al. (2004) found that women who were highly invested in mathematics exhibited greater levels of identity bifurcation compared to women who were not invested in math. Therefore, in the current study, I collected measures of investment in math (i.e., number of math classes taken in college, whether or not a participant took a math class over the last two semesters and identification with math) and included them in the analysis as covariates. In addition, numerous studies show that people who have high trait self-esteem are more likely to utilize different ego-protective strategies when they face threats to their self-integrity compared to people with lower self-esteem (e.g., Jordan, Spencer, Zanna, Hoshino-Browne, & Correll, 2003; McGregor, 2003; Rydell & Boucher, 2010). Therefore, in the current study, I collected baseline trait self-esteem scores for each participant to control for self-esteem effect on stereotype threat and identity bifurcation.

Method

Participants and Procedure

The participants were 138 female undergraduates[2] enrolled in introductory psychology classes at a large state university in the Rocky Mountain region (*Mean age* = 22 years, *SD* = 5.48) and participated either as part of a course requirement or in order to obtain extra credit. Participants were tested in sessions with one to four participants each. Most participants listed themselves as White (82.5%), 4.5% as Asian American, 6% as

[2]25 participants were not included in the analyses because they were international students, and I did not want cultural and language differences to influence the results.

Hispanic, 1.5% as African American/Black and 5.5% as "Other." Participants on average took two math classes in college (*SD* = 1.20).

Participants recruited for the current study first filled out a set of measures in an online survey in the following order. First, participants filled out Characteristics Questionnaire (Study 1) evaluating identity bifurcation. Next, they filled out the DIM (Smith & White, 2001) from Study 1 with two additional questions (*How many math classes have you taken in college?* and *When did you last take a math class?*) to assess investment in math. Subsequently, participants completed two measures of global gender identification, which are used as two separate indices. The first measure consisted of nine questions answered on a 5-point scale (1 = not at all, 5 = very much) and was adapted from the Identification with All Humanity Scale (McFarland, Webb, & Brown, 2012). The second measure consisted of four questions answered on a 7-point scale (1 = not at all, 7 = very much) and was taken from Spears, Doosje, and Ellemers (1997). Lastly, participants filled out a measure of trait self-esteem, which consisted of 10 questions answered on a 5-point scale (1 = strongly disagree; 5 = strongly agree) from the Rosenberg Self-esteem Scale (Rosenberg, 1965).

Anywhere from 7 days to 2 hours after completion of the online session, participants were invited to come to the laboratory to complete the study. When invited, the participants were told that they would take part in a set of experiments put together by different psychology labs and that the studies were not related to each other. They were informed that the experiments would involve reading a scientific article as well as evaluating an academic performance test and filling out some other cognitive and personality measures.

Stereotype threat manipulation. After the participants read and signed the informed consent, they were randomly assigned to one of three conditions: *stereotype threat activated, stereotype threat nullified, no stereotype threat*. In the *stereotype threat activated* condition, participants were informed that they were going to evaluate an academic exam as part of the study. Next, participants read a fictitious journal article in order to "get more background on academic assessments." The article described recent findings suggesting that there were gender differences in mathematics achievement (i.e., males outperform females). After reading the article, participants were informed that they would take and evaluate a math exam. In addition, participants were told that in this lab, researchers obtained results similar to the findings from the article showing that males considerably outperform females in mathematics. Next, participants were asked to solve two sample math problems that were similar to the ones on the exam. The article content as well as information provided after the article was used to evoke stereotype threat (see Smith & White, 2002; Thoman, White, Yamawaki, & Koishi, 2008). In the *threat nullified* condition, participants were presented with the same material as in the *threat activated* condition, but after the article they were told that no gender differences were found on the math test administered in this lab. This was expected to nullify the stereotype threat (e.g., Smith & White, 2002; see also Spencer & Steele, 1999; Keller, 2007). In *no stereotype threat* condition, participants did not read any articles. Instead, they were told that they would take and evaluate an academic exam and they were not told that the exam subject was math.

After stereotype threat manipulation, participants answered six questions that measured the extent to which they felt stereotype threat on an 11-point scale (1 = not at

all true of me, 11 = very true of me). Two questions in this manipulation check were designed to capture group-based stereotype threat (*People will think that women as a whole have less ability if I do not do well on this exam*; *I am concerned that people will judge women as a whole based on my performance on this exam*). The remaining questions asked about feelings of self-based stereotype threat (e.g., *Taking this exam could make me doubt my academic knowledge; If I don't do well on this exam, others may question my ability;* see Shapiro & Neuberg, 2007; Wout, Danso, Jackson, & Spencer, 2008; Zhang, Schmader, & Hall, 2013).

Identity bifurcation. Subsequently, all participants in the study filled out the Characteristics Questionnaire from the online session. This questionnaire was given to the participants to evaluate levels of identity bifurcation during the lab session and compare them to the levels of bifurcation from the online session.

Self-esteem and self-doubt measures. Due to concerns that explicit self-esteem and self-doubt measures in and of itself can be used as an ego-protective strategy in the face of stereotype threat (e.g., Steele, Spencer, & Lynch, 1993), I used unobtrusive measures to capture these two constructs in the study.

First, all participants completed the Initial Preference Task (IPT; e.g., LeBel & Gawronski, 2009; Stieger, Voracek, & Formann, 2012), which is a widely used implicit self-esteem measure based on the phenomenon that people prefer letters in their name over letters not in their name (Nuttin, 1985; 1987) as a reflection of a positive attitude towards the self (Greenwald & Banaji, 1995). In this task, participants were presented the letters of the alphabet (e.g., *A B C*) and other symbols (e.g., *£, ¿, #)* in random order and asked to rate how much they liked each item on a 5-point scale (1 = not at all, 5 = very

much). As part of the instructions for the IPT, participants were told that the ratings would help to develop stimuli for a study of linguistic and pictorial preferences (Stieger & Burger, 2013).

Even though duplicate administration of IPT was recommended to reduce measurement error (Stieger et al., 2012), IPT was administered only once in the current study due to concerns about length of the study and the fact that fatigue and irritation could influence performance on the working memory and math tests. At the end of the task, participants were asked: *Did you feel that any of the symbols had a special meaning for you?* If they responded *yes*, they were asked to list the symbols with special meaning and explain why each symbol had a special meaning to them. This information was collected to control for differences between those who recognize that letters in their name have special meaning and those who do not. Typically, those who acknowledge higher attractiveness of letters in their initials get higher scores on the IPT compared to "nonrecognizers" who do not assign special meaning to letters in their name (Stieger & Burger, 2013). Participants' initials were collected when they were asked to confirm that they wanted to submit their results by putting their initials into a box provided at the end of the survey.

Next, participants completed an unobtrusive measure of self-doubt about ability. This measure was described to participants as a word-fragment completion cognitive task. This task was expected to capture the activation of thoughts that were recently primed or self-generated. There were seven target items among 18 total word-fragment items, taken from Steele & Aronson (1995). The target items had as one possible solution a word indicating self-doubt, and they were the following: LO_ _ _ (LOSER); DU_ _

(DUMB); SHA _ _(SHAME); _ _ _E R I O R (INFERIOR); F L _ _ _ (FLUNK); _A R D (HARD); W_ _ K (WEAK). If participants felt doubt about their capability to perform well on the upcoming math exam, they were expected to fill in more target items with words expressing self-doubt.

Working memory task. Next, participants completed a verbal task ("vowel counting") measuring working memory capacity (Rydell & Boucher, 2010; Rydell et al., 2009; Schmader & Johns, 2003). In this task, participants first counted and reported the number of vowels in a simple sentence. After giving their answer, participants were instructed to remember a word that was presented on a computer screen for 1 second. After anywhere from four to six trials consisting of sentences and single words, participants were prompted to recall all of the single words presented to them in each trial. Working memory capacity score can be calculated with several different scoring algorithms (see Conway et al., 2005). However, partial-credit unit scoring (mean proportion of elements that were recalled correctly and credit given to partly correct items) is currently recommended due to its superior psychometric properties (Conway et al., 2005). The higher the partial-credit unit score, the greater working memory capacity. The vowel counting portion of the working memory test does not contribute to the score, but participants who were not accurate enough on the vowel counting portion (below 85% accuracy) were not included in the statistical analyses using working memory scores, following Conway et al. (2005).

Math exam. Next, participants took a multiple-choice math exam consisting of 30 problems preceded by a couple of practice problems. The math problems were derived from the Graduate Record Exam (GRE) general quantitative test. Participants had 20

minutes to complete the exam. Math performance in this research was evaluated by calculating the percentage of questions answered correctly out of total number of questions.

Postexam identification and self-integrity measures. After the exam, participants completed the same DIM and gender identification measures from the online session, along with a measure of self-integrity (Sherman et al., 2009). The self-integrity scale consisted of eight questions answered on a 7-point scale (1 = strongly disagree, 7 = strongly agree). It was administered at the end of the study because of a concern that if administered earlier, it could have been used as self-affirmation and contaminated the stereotype threat condition (e.g., Steele et al., 1993).

Procedural stereotype threat manipulation check. In order to assess whether the stereotype about women and math was successfully conveyed, we asked participants to answer a free recall question about what they remembered from the article given to them at the beginning of the study. Next, they had to answer a multiple-choice question asking what they were told about findings obtained in this lab regarding factors related to women and math ability with the following answer options: 1 = *No gender differences*; 2 = *Males are better at math*; 3 = *Females are better at math*, 4 = *Nothing was said about math ability in this lab*. Following completion, we debriefed the participants and gave them research credit.

Results

Stereotype Threat Manipulation Check

The two manipulation check questions measuring group-based stereotype threat feelings were highly correlated, $r(136) = .87$, $p < .0001$, so they were aggregated and

averaged to create an index reflecting group-based stereotype threat. The one-way ANOVA revealed a main effect of condition, $F(2, 135) = 4.34$, $p = .015$. Post-hoc analysis with Bonferroni adjustment showed that participants in the nullified stereotype threat and stereotype threat activated conditions reported similar levels of group-based stereotype threat, $p = .623$, (compare $M_{nullified} = 4.75$, $SD_{nullified} = 3.40$ and $M_{threat} = 4.40$, $SD_{threat} = 3.04$), and levels of group-based stereotype threat were significantly higher in those two conditions compared to the no stereotype threat condition, $p's < .031$, ($M_{no\ threat} = 3.08$, $SD = 2.60$).

The four manipulation check questions measuring self-based stereotype threat feelings were aggregated and averaged to create an index reflecting self-based stereotype threat feelings (Cronbach $\alpha = .97$). The one-way ANOVA revealed no significant effect of condition, $F(2, 133) = .032$, $p = .968$.

The finding that the nullified manipulation may not have successfully alleviated the group-based stereotype threat was further supported by looking at the procedural manipulation check completed at the end of the study. Participants in this condition were told that there were no gender differences found in the lab on the exam. However, 42% of the participants incorrectly reported what they were told about differences between men and women (28% reported that they were told that *males were better at math*, which mirrors the stereotype threat manipulation; 7% reported that they were told that *women were better than men at math*; 7% reported that *nothing was said about math ability in this lab*). In comparison, only 13% of stereotype threat condition participants incorrectly recalled what they were told in the lab (2.7% recalled *no gender differences*; 10.3% recalled *nothing was said about math ability in this lab*).

These findings suggest that the *no stereotype threat* and *stereotype threat* conditions were manipulated effectively only for group-based stereotype threat. However, stereotype threat nullification was not successfully conveyed in the current study. Therefore, results from the *nullified stereotype* threat condition have to be interpreted with caution.

Stereotype threat and change in identity bifurcation. Do women who experience stereotype threat respond to it with greater identity bifurcation? This question was investigated in a series of hierarchical regression analyses. First, I analyzed separately the difference score between participants' online session scores and the lab session scores in self-identification with stereotype-relevant characteristics (Cronbach $\alpha_{online\ session}$ = .70, Cronbach $\alpha_{lab\ session}$ = .73) and stereotype-not-relevant characteristics (Cronbach $\alpha_{online\ session}$ = .30, Cronbach $\alpha_{lab\ session}$ = .45), following operationalization procedures used by Pronin and colleagues (2004). Online session scores were subtracted from the lab session scores. In the first regression analysis, self-identification with stereotype-relevant characteristics change score was used as the outcome with the following variables entered in Step 1 as predictors: stereotype threat manipulation dummy coded with no stereotype threat condition used as control group (code one: *no stereotype threat* = 0, *stereotype threat* = 0, *stereotype threat nullified* =1; code two: *no stereotype threat* = 0, *stereotype threat* =1, *nullified stereotype threat* = 0) and self-identification with stereotype-relevant characteristics from the online session to control for baseline levels of self-identification with stereotype-relevant characteristics. In addition, the following covariates were entered in Step 1: mean-centered trait self-esteem score (Cronbach α = .88) and mean-centered domain identification score collected in the online session (Cronbach α = .94),

number of math classes taken in college, and whether the participant recently took a math class (no = 0, yes =1). Next, interactions between the covariates and condition codes were entered in Steps 2 to 5 to see if investment in math and trait self-esteem moderate the effect of stereotype threat on self-identification with stereotype-relevant characteristics (see Table 2 for order in which interactions were entered). This analysis revealed no significant main effects or interactions, $F(15, 97) = 1.15$, $p = .322$ (see Table 2). The model from Step 1 was the closest to being significant, $F(7, 105) = 1.61$, $p = .14$, and revealed a trend such that those women who were in the stereotype threat condition showed lower identification with stereotype-relevant characteristics in the lab session compared to online session, $B = -.22$, $t(105) = -1.81$, $p = .072$, semiparial $r^2 = .02$.

The same hierarchical regression analysis with self-identification with stereotype-not-relevant characteristics difference score controlling for baseline self-identification with stereotype-not-relevant characteristics from the online session revealed no significant main effects and interactions, $F(15, 99) = 1.15$, $p = .326$ (see Table 2). The overall pattern of results for stereotype-relevant and stereotype-not-relevant identification indicates a weak sign of change in identity bifurcation as predicted and operationalized by Pronin et al. (2004).

As seen in Table 2, the analysis using the same hierarchical regression model and the identity bifurcation relative index as an outcome controlling for baseline levels of identity bifurcation revealed a change in identity bifurcation between the online and lab sessions. As predicted, only the women who were assigned to the stereotype threat condition showed an increase in identity bifurcation, such that they showed lower identification with stereotype-relevant characteristics in the lab session compared to the

Table 2. Hierarchical regression analyses predicting change in identity bifurcation

	Change in stereotype relevant set			Change in stereotype NOT relevant set			Change in identity bifurcation relative index		
Predictors	B	Semipartial r^2	F Change	B	Semipartial r^2	F Change	B	Semipartial r^2	F Change
Step 1			1.61^{+}			1.43			3.02**
Baseline	-0.09	0.02		-0.08	0.02		-0.16*	0.05	
No threat (0) vs. null threat (1)	0.03	0.00		0.15	0.01		0.15	0.01	
No threat (0) vs. threat (1)	-0.23	0.02		0.12	0.01		0.42*	0.06	
Trait self-esteem	-0.01	0.00		0.00	0.00		0.01	0.00	
Recently took math class (no = 0, yes = 1)	-0.16	0.01		0.09	0.01		0.27	0.02	
Number of math classes taken in college	0.16	0.05		0.03	0.01		0.12^{+}	0.03	
Domain Identification (DI)	0.00	0.00		-0.01	0.01		0.00	0.00	
Step 2			0.84			0.02			0.97
No threat vs. null threat by DI	0.01	0.01		0.00	0.00		-0.01	0.00	
No threat vs. threat by DI	-0.01	0.00		0.00	0.00		0.01	0.00	
Step 3			0.38			0.19			0.04
No vs. null threat by self-esteem	0.01	0.00		0.01	0.00		0.00	0.00	
No vs. threat by self-esteem	0.00	0.00		0.00	0.00		0.00	0.00	
Step 4			1.91			2.34			0.12
No vs. null threat by number of math classes taken in college	-0.13	0.02		-0.10	0.02		0.06	0.00	
No vs. threat by number of math classes taken in college	-0.19	0.03		-0.14	0.03		0.03	0.00	
Step 5			0.03			1.09			0.88
No vs. null threat by recently took math class	0.00	0.00		-0.07	0.00		-0.14	0.00	
No vs. threat by recently took math class	0.06	0.00		-0.25	0.02		-0.35	0.02	

Note: Baseline in each regression analyis is equivalent to the outcome measure but measured in the pre-experimental online session.

** significant at the $p < .007$ level; * significant at the $p < .05$ level; $^{+}$ significant at the $p < .14$ level.

online session, $B = .42$, $t(92) = 2.50$, $p <. 012$, semiparial $r^2 = .06$.

Next, the same regression analysis was conducted with change in self-identification with masculine characteristics as an outcome controlling for baseline. This analysis was conducted to test for possibility that women in stereotype threat condition increased identification with masculine characteristics and it revealed no significant main effects or interactions, $F(15, 102) = .90$, $p = .563$. Therefore, women who experienced stereotype threat showed no sign of increased identification with masculine traits.

Stereotype threat and change in identification with gender. Finally, I tested whether women changed identification with global gender in response to stereotype threat. I assessed global gender identification with two separate measures, a measure adapted from the Identification with All Humanity Scale (Cronbach $\alpha_{online\ session} = .85$, Cronbach $\alpha_{lab\ session} = .83$) and gender identification scale from Spears et al. (1997; Cronbach $\alpha_{online\ session} = .85$, Cronbach $\alpha_{lab\ session} = .86$). Correlation between the two measures was high both in the online session, $r\,(134) = .57$, $p < .0001$, and the lab session, $r\,(136) = .71$, $p < .0001$. I used the same hierarchical regression model to test for change in global gender identification as the one used to test for change in identity bifurcation. However, math test scores and working memory capacity were added to the model as additional covariates to control for performance on those two tests affecting global gender identification for the lab session. The main effect of stereotype threat manipulation and interactions were not significant, ps $> .172$. This pattern of results suggests that women did not respond to stereotype threat by disidentifying with their global gender identity.

Effects of Stereotype Threat on Math Performance

Did stereotype threat have a negative effect on math performance? I conducted a hierarchical regression analysis with math performance used as the outcome and stereotype threat manipulation coded (contrast 1: *nullified threat* = 1, *no threat* = 0, *stereotype threat* = 0; contrast 2: *nullified threat* = 0, *no threat* = 0, *stereotype threat* = 1) and entered in Step 1 with the following covariates: mean-centered trait self-esteem score and mean-centered domain identification score collected in the online session, number of math classes taken in college, and whether the participant recently took a math class (no = 0, yes = 1). Next, interactions between the covariates and condition codes were entered in Steps 2 to 5 to test if investment in math and trait self-esteem moderated the effect of stereotype threat on math performance. The regression analysis was significant, $F(14, 113) = 2.40$, $p = .006$. However, stereotype threat manipulation did not have a direct effect on math performance, $p < .45$. In fact, the only significant predictor in the model was domain identification, $B = .74$, $t(113) = 2.31$, $p < .022$, semiparial $r^2 = .04$. Not surprisingly, those who reported higher identification with math performed better on the math test (e.g., Smith & White, 2001).

However, the main goal of this study was to test a serial mediation model in which the negative effect of stereotype threat on performance is alleviated through identity bifurcation having a positive effect on self-concept and working memory capacity. According to recent conceptualizations of mediation, this indirect effect of stereotype threat on math performance can be tested even when the individual relationship between stereotype threat and math performance is not detected (see Hayes, 2009).

Overview of Mediation Analyses

If identity bifurcation is used as an ego-defensive strategy in the face of stereotype threat, then it may have a positive effect on self-concept (boost self-esteem, restore self-integrity, and decrease self-doubt about ability). This positive effect, in turn, may help to preserve working memory capacity, which may result in better math performance. This mechanism was tested in a sequence of serial mediation models performed using bootstrapping method (Hayes, 2013). The outcome in the mediation analyses was math performance. The independent variable in all the mediation analyses was stereotype threat manipulation contrast 2 (*nullified threat* = 0, *no threat* = 0, *stereotype threat* = 1). Contrast code 1 (*nullified threat* = 1, *no threat* = 0, *stereotype threat* = 0) was entered into the model as a covariate. Contrast codes entered in this configuration allowed testing the difference between stereotype threat and no stereotype threat condition. The mediators were change in identity bifurcation relative index, self-concept measures (doubt about ability, implicit self-esteem, and self-integrity), and working memory. The three self-concept constructs were entered in separate mediation models to test their individual impact on working memory (see Figures 1, 2, and 3).

The following covariates were included in the model: identity bifurcation relative index from the online session, trait self-esteem score and domain identification score collected in the online session, number of math classes taken in college, and whether the participant recently took a math class (no = 0, yes = 1).

Effect of stereotype threat on math performance through identity bifurcation, self-doubt about ability, and working memory. After deletion of 45 cases due to missing values and exclusion criteria for the working memory test, data from 95 women were

available for analysis. The 95% bias-corrected bootstrap confidence intervals for all the indirect effects in this analysis contained zero, indicating no significant indirect effects in the model with self-doubt as the self-concept mediator. Thus, as shown in Figure 1, stereotype threat did not predict math performance through a change in identity bifurcation such that self-doubt about ability decreased with a subsequent increase in working memory. However, the effect of stereotype threat on identity bifurcation approached significance (p = .10). This suggests a trend such that women who were in the stereotype threat condition identified less with stereotype-relevant characteristics compared to the online session. In addition, the effect of working memory on math performance was statistically significant (p = .009). Greater working memory capacity predicted better math performance.

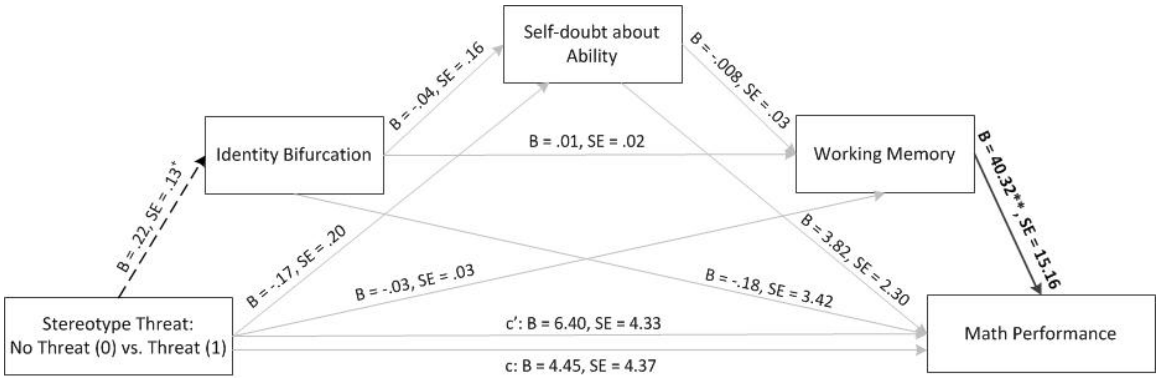

Figure 1. Path coefficients for serial mediation on math performance through identity bifurcation, self-doubt about ability, and working memory. Lines in bold indicate significant direct effects, and dashed lines indicate marginally significant effects; lines in light grey indicate no significant direct effects; ** p = .009, + p = .10; c' indicates direct effect of stereotype threat on math performance; c indicates total effect of stereotype threat on math performance. Covariates that were included in the model are described in text but are not shown in this figure.

Effect of stereotype threat on math performance through identity bifurcation, implicit self-esteem, and working memory. Implicit self-esteem in this study was estimated with Initial Preference Task (IPT). The IPT score can be calculated with five different scoring algorithms; however, it is currently recommended to use so called Ipsatized double-correction algorithm (I-algorithm) due to its optimal psychometric properties (Stieger & Burger, 2013). Therefore, I-algorithm formula provided in the SPSS syntax from LeBel & Gawronski (2009) was used to calculate implicit self-esteem scores in the current study. Moreover, an additional covariate was added to this mediation model. This variable categorized participants as 1 = those who admitted that letters in their name had a special meaning (recognizers) and 2 = those who did not recognize letters in their name as special (nonrecognizers), and it was added to control for the fact that participants who assign special meaning to their initials typically score higher on IPT (LeBel & Gawronski, 2009).

After deletion of 72 cases with missing values and unmet criteria for the working memory test, data from 66 women were available for analysis. The 95% bias-corrected bootstrap confidence intervals for all the indirect effects in this model contained zero, indicating no significance. As shown in Figure 2, stereotype threat did not predict math performance through a change in identity bifurcation such that implicit self-esteem increased with a subsequent increase in working memory.

Effect of stereotype threat on math performance through identity bifurcation, self-integrity, and working memory. After deletion of 46 cases with missing values and unmet criteria for working memory test, data from 92 women were available for analysis. The

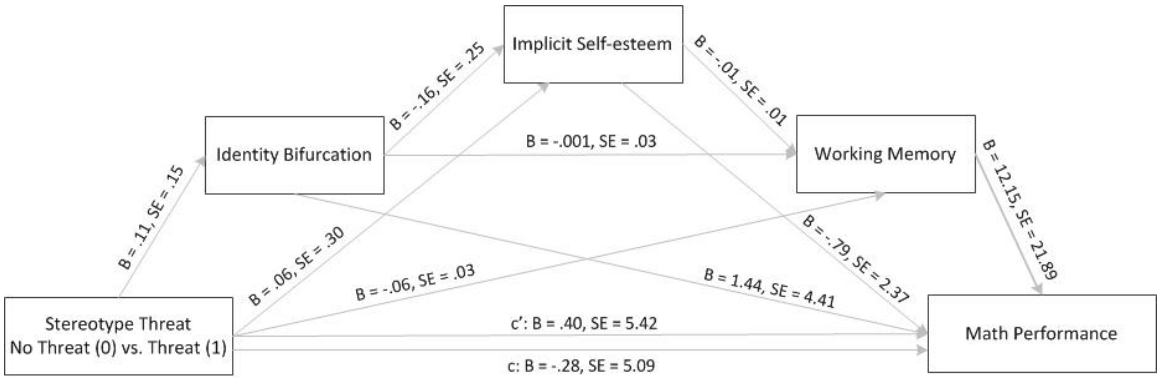

Figure 2. Path coefficients for serial mediation on math performance through identity bifurcation, implicit self-esteem, and working memory. Lines in bold indicate significant direct effects, and dashed lines indicate marginally significant effects; lines in light grey indicate no significant direct effects; c' indicates direct effect of stereotype threat on math performance; c indicates total effect of stereotype threat on math performance. Covariates that were included in the model are described in the document but are not shown in this figure.

95% bias-corrected bootstrap confidence intervals for the indirect effect through self-integrity and working memory did not contain zero, indicating statistical significance (indirect effect = -.50, bootstrap *SE* = .42; 95% bias-corrected bootstrap confidence interval of -2.37 to -.04; see Figure 3). This was the only significant indirect effect in the model showing that stereotype threat negatively affected math performance through impacting self-integrity, which in turn affected working memory.[3] In addition, similar to what was found in the analysis involving self-doubt, the effect of stereotype threat on identity bifurcation approached significance (p =.09). Last, the direct effect of stereotype threat on math performance was marginally significant (p = .10).

[3] Since self-integrity was measured at the end of the study, one could argue for an alternative serial mediation model in which self-integrity would be analyzed as the outcome being affected by stereotype threat through identity bifurcation, working memory and math performance acting as serial mediators. This alternative model was tested and the results are not as compelling compared to the original model (see results and discussion for the alternative model in Appendix).

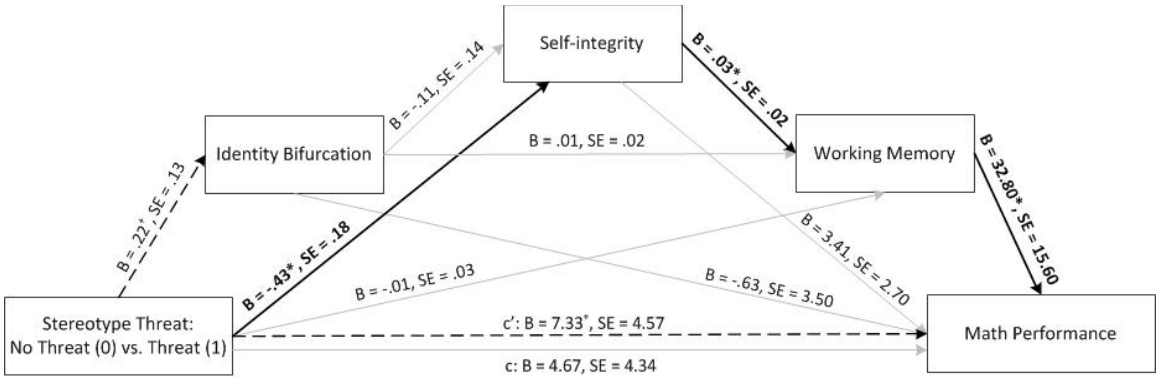

Figure 3. Path coefficients for serial mediation on math performance through identity bifurcation, self-integrity, and working memory. Lines in bold indicate significant direct effect, dashed lines indicate marginally significant effects; lines in light grey indicate no significant direct effect; $^{+}$ $p \leq .10$, * $p < .05$; c' indicates direct effect of stereotype threat on math performance; c indicates total effect of stereotype threat on math performance. Covariates that were included in the model are described in text but are not shown in this figure.

Discussion

Study 2 results show that experience of stereotype threat triggers an increase in identity bifurcation. When operationalization of bifurcation in identity suggested by Pronin and colleagues (2004) was used, it showed a trend such that women were less likely to describe themselves using stereotype-relevant characteristics after they were put in a stereotype threat situation. When an identity bifurcation relative index was used, this trend became a statistically significant effect. Taken together, both identity bifurcation operationalizations demonstrate that women engage in this strategy when they are being stereotyped. In addition, this research showed no evidence that women simply increased identification with masculine characteristics or rejected their global gender identity under stereotype threat. These results are consistent with previous findings and further support the idea that identity bifurcation is about selective disidentification with only those

feminine characteristics that are associated with the negative stereotype (Pronin et al., 2004).

This study also shows that women experienced stereotype threat and it showed that negative stereotypes led to underperformance on a math test, which supports previous research (e.g., Nosek et al., 2009; Spencer et al., 1999). Interestingly, the link between stereotype threat and math performance in the current study was not a direct causal path, but it occurred through self-integrity and working memory acting as serial mediators. This is an important finding because it provides direct, empirical evidence that stereotypes can undermine performance as a threat to self-integrity, which, in turn, negatively impacts working memory capacity. This mechanism was proposed in previous research as the explanation for how stereotypes undermine performance in a stereotyped domain, but it has not been demonstrated before, to the best of my knowledge (e.g., Martens et al., 2006, Johns, Inzlicht, Schmader, 2008, Schmader et al., 2008, von Hippel et al., 2005).

This study also tested whether stereotype threat can increase self-doubt about ability and decrease self-esteem, which, in turn, could reduce working memory capacity and diminish math performance. Results showed that self-doubt about ability and self-esteem did not account for the relationship between stereotype threat, working memory, and math performance. However, this null finding has to be interpreted with caution. First of all, the unobtrusive measure of self-doubt showed problems with validity. The word-fragment completion task used to measure self-doubt was supposed to capture thoughts that were recently activated. This task was administered after the Characteristics Questionnaire, and I suspect that results from this task were contaminated by some of the

traits in the Characteristics Questionnaire (e.g., being flirtatious). For example, word fragment F L _ _ _ (FLUNK) was filled in as "FLIRT" by 21% of participants in the study. In addition, the task could have been contaminated by other thoughts not germane to the task at hand. For example, word fragment DU_ _ (DUMB) was filled in as "DULL" by 26 % of participants. In both cases, participants were equally distributed among conditions ($\chi^2 > 0.98$, $ps < .36$). These examples show that measure of self-doubt about ability used in this study had weak validity, making it difficult to draw meaningful conclusions about the relationship between stereotype threat and self-doubt about ability.

As far as the analyses involving implicit self-esteem are concerned, data show that this analysis was underpowered ($power_{1-\beta \text{ err prob}} = 0.06$) because almost half of all participants were not included in the analyses. Initial Preference Task used in this study to measure implicit self-esteem requires participants to rate every letter of the alphabet in addition to other symbols. As many as 42 participants skipped at least one item on this task and were not included in the analyses due to these missing values. An additional 26 participants were not included in the analyses because they were not accurate enough on the working memory test, which resulted in a dramatic loss of power. Therefore, lack of relationship between stereotype threat and implicit self-esteem showed in this research may not be a reliable finding. This finding would have to be replicated with a larger number of participants.

Lastly, this study attempted to test whether identity bifurcation protects the self-concept under stereotype threat, which, in turn, preserves working memory and leads to better math performance. Results showed that women who were under stereotype threat used identity bifurcation, but identity bifurcation did not have an ego-protective impact

on the self-concept components. There was also no direct or indirect relationship between identity bifurcation and working memory and math performance. In addition, the fact that women who were put in the stereotype threat situation reported a lower sense of self-integrity provides further support that identity bifurcation did not protect those women from the negative effects of stereotype threat.

It is possible that the identity bifurcation change effect was not big enough in the mediation analyses (semipartial r^2 = .03 for the analysis involving self-integrity and self-doubt about ability) to have impact on self-concept. A large number of participants were not included in the mediation analyses due to missing data, which lowered the significance and magnitude of an already small identity bifurcation effect.

Why did women in this study show only a small change in identity bifurcation under stereotype threat? Looking at the nature of stereotype threat manipulation used in the current study suggests a possible answer to this question. Manipulation check data revealed that the stereotype threat manipulation used in the current study evoked feelings of group-based stereotype threat, but it did not evoke self-based stereotype threat feelings. The primary concern in the group-based stereotype threat is about confirming the negative stereotypes for the ingroup (e.g., If I do poorly on this test, I will confirm the stereotype that all women are bad at math). In contrast, the primary concern in the self-based stereotype threat is about confirming negative performance stereotypes for the self (e.g., If I do poorly on this task, I will question my own ability and epitomize the stereotype; Shapiro & Neuberg, 2007). Type of threat (group-based vs. self-based) could influence the extent to which a particular ego-defensive strategy will be employed to reduce the threat. Research shows that self-based interventions such as self-affirmation

effectively address self-based threats, while group-based interventions (e.g., looking at examples of successful role models) help to cope with group-based stereotype threat (Shapiro, Williams, & Hambarchyan, 2013). Following this logic, if a person experiences a group-based threat (like participants in this research did), they would be more likely to use a group-based strategy to cope effectively with the threat. However, identity bifurcation is a self-based strategy because it focuses people on themselves and different characteristics and activities that apply and do not apply to them. In addition, the nature of bifurcation is to protect oneself from the negative effects of stereotype threat and not about being concerned about the outcomes for the ingroup (Pronin et al., 2004). To sum up, identity bifurcation is an ego-protective strategy that may not be compatible with the type of stereotype threat invoked in this study. This may explain why this strategy was employed only to a small extent by our female participants and eventually resulted in no impact on self-concept, working memory, and math performance.

While the study demonstrated that identity bifurcation indeed can be triggered by stereotype threat, it would be more appropriate to test the ego-protective qualities of identity bifurcation in a self-based stereotype context. In this context, participants could be more likely to use this strategy because it addresses self-based stereotype threat concerns. As a result, identity bifurcation effect could be strong enough to play a role in reducing the negative impact of stereotype threat on working memory and math performance by affecting self-concept.

GENERAL DISCUSSION

When people become objects of stereotyping, it can make them feel less competent, less valued, and less in charge. It is not surprising that people use different ego-protective strategies to deal with such negative feelings. This research investigated whether one such strategy called identity bifurcation affected self-concept and protected participants from negative cognitive and performance outcomes of stereotype threat.

Narratives from women in STEM (science, technology, engineering, mathematics) indicate that identity bifurcation may be used to avoid negative effects of stigma (see Seymour & Hewitt, 1997). Identity bifurcation phenomenon has also been successfully demonstrated in the lab and replicated in scientific experiments (e.g., Pronin et al., 2004). The current research shows more evidence that selective changes in feminine identity may be triggered by circumstances that pose a potential threat to self-integrity such as being in a stereotype threat situation.

The preliminary study confirmed that women think about certain feminine characteristics as being compatible and incompatible with success in quantitative domains. Stereotypically feminine characteristics such as acting flirtatious, being emotional, or behaving in a playful manner were viewed as putting women at risk of negative judgment.

Subsequently, Study 1 showed that women who identified with math had a tendency not to identify with those stereotypically feminine characteristics that were

categorized in the preliminary study as incompatible with success in math. However, this was not simply an overall rejection of the feminine identity or just an adoption of a more masculine identity. It appears to be a selective change in identity along the dimension of stereotype relevance.

This finding was further supported in Study 2 when an increase in identity bifurcation occurred only for female participants who were exposed to stereotype threat. I expected that people would engage in identity bifurcation under these circumstances as a way to protect their self-concepts, which would translate to better performance outcomes. Surprisingly, and in contrast to hypotheses, those changes in feminine identity did not influence women's feelings about themselves (self-esteem, doubt about performance) and did not help to restore a positive sense of self-integrity, which proved to be negatively affected by stereotype threat. This finding raises questions about the nature of identity bifurcation. Are there other stereotype threat contexts that could increase the tendency to use identity bifurcation to the extent to which it could have an effect on self-concept? Can automatic as opposed to more deliberate use of identity bifurcation result in different performance outcomes for individuals who employ this strategy?

First of all, identifying the circumstances in which bifurcation in feminine identity is employed could strengthen and expand the current line of research. As suggested in Study 2, identity bifurcation is a strategy that is expected to influence how women perceive themselves and address the outcomes for the self. However, current research used and evoked a more group-based conceptualization of stereotype threat (e.g., Shapiro et al., 2013). While bifurcation did occur in the current work, it may have had more impact on the self-concept mechanisms and performance outcome if utilized in the

context of a self-based stereotype threat where fears and concerns are focused on the individual and not the group as being the object of stereotyping.

Identity bifurcation is proposed to occur for more than just helping people to feel good about themselves when faced with stereotypes. I expected that by protecting the ego, identity bifurcation could free up cognitive resources expended to combat the threat and help performance on the task at hand (e.g., Schmader et al., 2008). It is possible that for identity bifurcation to help reduce negative effects of stereotype threat on performance, the process of bifurcation needs to occur automatically. Performance under stereotype threat requires a significant amount of attention and cognitive capacity because it involves focusing on the task at hand under suboptimal conditions (i.e., stereotype threat). In this context, people may have extra difficulty in deliberately and consciously employing different ego-protective strategies to deal with stereotype threat and perform at the same time. Even if individuals do end up successfully using an ego-protective strategy to deal with the threat, it may still take away time and attention from the task at hand and may contribute to poor performance. If the use of an ego-protective strategy is automatic and effortless, it may address the threat without diverting working memory resources away from the task at hand, which could result in better performance. Participants in this research were female undergraduate psychology students, and I suspect that for them the use of identity bifurcation was more deliberate. Those female students may encounter fewer situations in which the stereotype of women in math can be applied to them (e.g., they take fewer quantitative classes) compared to female students who are majoring in STEM fields, so they may not be accustomed to making frequent adjustments in their feminine identity. In contrast, women in STEM fields may be more

likely to frequently use identity bifurcation. Specifically, these women take more classes in quantitative domains, so there is more opportunity for them to become an object of stereotyping. Future research should explore ego-protective properties of identity bifurcation, specifically with women in quantitative fields. I predict that identity bifurcation may help those women perform better in situations when they are at risk of being stereotyped because it may be more automatic for them and require fewer cognitive resources compared to women who have less opportunity to use it or are not accustomed to using it.

Furthermore, some women may not have to make selective changes in their feminine identity because characteristics that are stereotype-relevant are simply not a part of their identity (e.g., those women would never describe themselves as emotional or chatty). This state could be defined as being chronically bifurcated. Chronic bifurcation may be equivalent to maintaining a stable consistent identity. Therefore, it may be beneficial for self-concept and performance outcomes in the stereotyped domain. Research has shown that maintaining a consistent identity (i.e., not having to switch between multiple identities such as being a scientist and a mother) may lead to better performance outcomes and increase well-being in general (e.g., Settles, 2004). It would be interesting to test whether no bifurcation or being chronically bifurcated has similar benefits.

Lastly, it would be interesting to further investigate the long-term consequences of using identity bifurcation. Employing this strategy could seem like a good idea because “fitting in” helps to avoid stigma, rejection, and discrimination. However, this strategy may not be sustainable as demonstrated by the story of Eileen Pollack who

eventually left physics because she got tired of managing the perceptions of others in order to "fit in." One reason why this strategy may not work in the long term is because leading a "dual life" may invoke unpleasant feelings of inconsistency and cognitive dissonance (e.g., Aronson, 1992; Festinger, 1957). If these feelings are not reconciled, they may result in disidentification with the stigmatized domain or leaving the domain.

Despite lack of empirical support for its ego-protective benefits, identity bifurcation is used by women who are in male dominated fields and are constantly under pressure of being scrutinized and stereotyped. Therefore, it is important to further explore the costs and advantages of this strategy. Future research on identity bifurcation should focus on understanding better when identity bifurcation occurs, whether it can be beneficial and for who as well as its long-term consequences.

Theoretical and Practical Contributions

This research found that stereotypes threaten self-integrity and that feeling less valued and less in control may have a negative impact on cognitive functioning and performance outcomes. This contributes to stereotype theory and has implications for interventions employed to reduce stereotype threat. Practitioners who work with populations who are at risk of experiencing stereotype threat (e.g., teachers of girls in STEM) should be encouraged to use self-integrity restoring interventions such as self-affirmation (e.g., Cohen, Garcia, Apfel, & Master, 2006; Frantz, Cuddy, Burnett, Ray, & Hart, 2004, Martens et al., 2006) and should develop new techniques that directly address issues with self-integrity to protect the performance of those who are at risk of being stereotyped.

CONCLUSION

This research indicates that women may sometimes disavow stereotypically feminine characteristics that are not compatible with being successful in quantitative domains. Specifically, this bifurcation in feminine identity occurs in response to stereotype threat and may be particularly characteristic of women who are identified with quantitative domains. Identity bifurcation is considered an ego-protective strategy that is expected to shield women from negative consequences of being stigmatized (Pronin et al., 2004). However, women who were exposed to stereotype threat in the current research showed diminished sense of self-integrity, which negatively affected their working memory capacity and subsequently led to underperformance on a math test. Those negative effects of stereotype threat were not alleviated by the use of identity bifurcation.

APPENDIX

A serial mediation analysis revealed that stereotype threat affected math performance through self-integrity and working memory acting as serial mediators. However, self-integrity was measured at the end of the study, so one could argue that self-integrity should be treated as the outcome and not a mediator. The test of this alternative model using the same mediation technique with the same covariates in which stereotype threat affected self-integrity through identity bifurcation; working memory and math performance acting as serial mediators revealed significant negative direct effect of stereotype threat on self-integrity. The positive direct effect of working memory on math performance was also significant. The 95% bias-corrected bootstrap confidence intervals for all the indirect effects in this model contained, zero indicating that indirect effects were not significant (see Figure 4).

Even though this mediation model is a valid alternative statistically, theoretically it is not as compelling as the original model. First of all, the original model of stereotype threat affecting math performance through changes in self-integrity and working memory has been proposed and tested indirectly by previous research (e.g., Johns et al., 2008; Martens et al., 2006; Schmader et al., 2008). Furthermore, while evaluation of participants' self-integrity occurred at the end of the study, it is unlikely that participants' self-integrity was affected only at the end of the study and not earlier in the study. At the

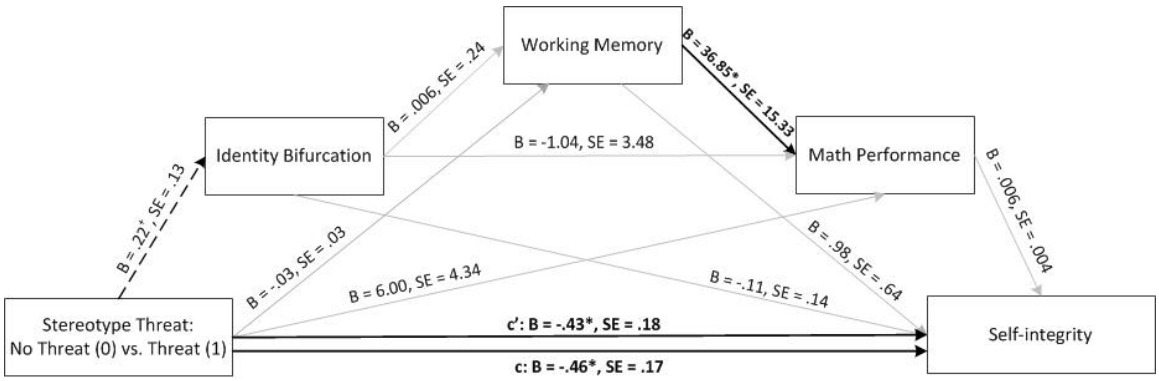

Figure 4. Path coefficients for serial mediation on self-integrity through identity bifurcation, working memory, and math performance. Lines in bold indicate significant direct effects, and dashed lines indicate marginally significant effects; lines in light grey indicate no significant direct effects. * $p < .05$, $^{+}$ $p = .09$; c' indicates direct effect of stereotype threat on self-integrity; c indicates total effect of stereotype threat on self-integrity. Covariates that were included in the model are described in text but are not shown in this figure.

beginning of the study, participants heard that "women were not as good at math as men" and that they would take a difficult math test later in the study. This information, most likely got participants worried about their performance and negatively affected their perceptions of being valued as females early on in the study. Those concerns were to some extent reflected in the manipulation check scores. Furthermore, if participants' self-integrity was affected only at the end of the study, it would likely be affected by performance measures collected at the end of the study (i.e., working memory capacity and math performance). However, the alternative model shows no evidence that performance on the working memory and math tests influenced self-integrity. Therefore, I argue that the alternative mediation model treating self-integrity as an outcome is not as theoretically sound as the model using self-integrity as the mediator.

REFERENCES

Ambady, N., Paik, S. K., Steele, J., Owen-Smith, A., & Mitchell, J. P. (2004). Deflecting negative self-relevant stereotype activation: The effects of individuation. *Journal of Experimental Social Psychology, 40*(3), 401–408.

Aronson, E. (1992). The return of the repressed: Dissonance theory makes a comeback. *Psychological Inquiry, 3*, 303–311.

Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). When white men can't do math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social Psychology, 35*(1), 29–46.

Beilock, S. L., Kulp, C. A., Holt, L. E., & Carr, T. H. (2004). More on the fragility of performance: Choking under pressure in mathematical problem solving. *Journal of Experimental Psychology: General, 133*(4), 584–600.

Beilock, S. L., Rydell, R. J., & McConnell, A. R. (2007). Stereotype threat and working memory: Mechanisms, alleviation, and spillover. *Journal of Experimental Psychology: General, 136*(2), 256–276.

Branscombe, N. R., Schmitt, M. T., & Harvey, R. D. (1999). Perceiving pervasive discrimination among African Americans: Implications for group identification and well-being. *Journal of Personality and Social Psychology, 77*(1), 135–149.

Cadinu, M., Maass, A., Rosabianca, A., & Kiesner, J. (2005). Why do women underperform under stereotype threat?: Evidence for the role of negative thinking. *Psychological Science, 16*, 572–578.

Cohen, G. L., Garcia, J., Apfel, N., & Master, A. (2006). Reducing the racial achievement gap: A social-psychological intervention. *Science, 313*, 1307–1310.

Conway, A. A., Kane, M., Bunting, M., Hambrick, D. Z., Wilhelm, O., & Engle, R. (2005). Working memory span tasks: A methodological review and user's guide. *Psychonomic Bulletin & Review, 12*(5), 769–786.

Crabtree, J. W., Haslam, S. A., Postmes, T., & Haslam, C. (2010). Mental health support groups, stigma, and self-esteem: Positive and negative implications of group identification. *Journal of Social Issues, 66*(3), 553–569.

Crocker, J., & Major, B. (1989). Social stigma and self-esteem: The self-protective properties of stigma. *Psychological Review, 96*, 608–630.

Crocker, J., Major, B., & Steele, C. M. (1998). Social stigma. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The Handbook of Social Psychology* (4th ed., Vol. 2, pp. 504–553). New York: McGraw Hill.

Crocker, J., & Wolfe, C. T. (2001). Contingency of self-worth. *Psychological Review, 108*, 593–673.

Davies, P. G., Spencer, S. J., Quinn, D. M., & Gerhardstein, R. (2002). Consuming images: How television commercials that elicit stereotype threat can restrain women academically and professionally. *Personality and Social Psychology Bulletin, 28*(12), 1615–1628.

Ethier, K. A., & Deaux, K. (1994). Negotiating social identity when contexts change: Maintaining identification and responding to threat. *Journal of Personality and Social Psychology, 67*(2), 243–251.

Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

Fordham, S., & Ogbu, J. U. (1986). Black students' school success: Coping with the "burden of 'acting white'." *The Urban Review, 18*(3), 176–206.

Frantz, C. M., Cuddy, A. J. C., Burnett, M., Ray, H., & Hart, A. (2004). A threat in the computer: The race Implicit Association Test as a stereotype threat experience. *Personality and Social Psychology Bulletin, 30*(12), 1611–1624.

Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102,* 4–27.

Haslam, S. A., O'Brien, A., Jetten, J., Vormedal, K., & Penna, S. (2005). Taking the strain: Social identity, social support, and the experience of stress. *British Journal of Social Psychology, 44*(3), 355–370.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs, 76*(4), 408–420.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: The Guilford Press.

Johns, M., Inzlicht, M., & Schmader, T. (2008). Stereotype threat and executive resource depletion: Examining the influence of emotion regulation. *Journal of Experimental Psychology: General, 137*(4), 691–705.

Jordan, C. H., Spencer, S. J., Zanna, M. P., Hoshino-Browne, E., & Correll, J. (2003). Secure and defensive high self-esteem. *Journal of Personality & Social Psychology, 85*(5), 969–978.

Keller, J. (2007). Stereotype threat in classroom settings: the interactive effect of domain identification, task difficulty and stereotype threat on female students' math performance. *The British Journal of Educational Psychology, 77*(2), 323–338.

Kelso, J. A. S. (1995). *Dynamic patterns: The self-organization of brain and behavior*. Cambridge, MA: MIT Press.

LeBel, E. P., & Gawronski, B. (2009). How to find what's in a name: Scrutinizing the optimality of five scoring algorithms for the name-letter task. *European Journal of Personality, 23*(2), 85–106.

Major, B., Spencer, S., Schmader, T., Wolfe, C. T., & Crocker, J. (1998). Coping with negative stereotypes and intellectual performance: The role of psychological disengagement. *Personality & Social Psychology Bulletin, 24*, 34–50.

Martens, A., Johns, M., Greenberg, J., & Schimel, J. (2006). Combating stereotype threat: The effect of self-affirmation on women's intellectual performance. *Journal of Experimental Social Psychology, 42*(2), 236–243.

Mazur, D. (2011). *Stereotype threat and affirmation: The interactive effect of domain and gender identification, and different types of affirmation on women's math performance* (Unpublished Master's thesis). University of Utah, Salt Lake City.

McFarland, S., Webb, M., & Brown, D. (2012). All humanity is my ingroup: A measure and studies of identification with all humanity. *Journal of Personality and Social Psychology, 103*(5), 830–853.

McGregor, I., & Marigold, D. C. (2003). Defensive zeal and the uncertain self: What makes you so sure? *Journal of Personality & Social Psychology, 85*(5), 838–852.

Nosek, B. A., Shiomura, K., Tulbure, B. T., Wiers, R. W., Olli, E., … Greenwald, A. G. (2009). National differences in gender-science stereotypes predict national sex differences in science and math achievement. *Proceedings of the National Academy of Sciences of the United States of America, 106*(26), 10593–10597.

Nuttin, M. J., Jr. (1987). Affective consequences of mere ownership. The name letter effect in twelve European languages. *European Journal of Social Psychology, 17*, 381–402.

Nuttin, M. J., Jr. (1985). Narcissism beyond Gestalt and awareness: The name letter effect. *European Journal of Social Psychology, 64*, 723–739.

Ogbu, J. U. (2004). Collective identity and the burden of "acting white" in black history, community, and education. *The Urban Review, 36*(1), 1–35.

Pollack, E. (2013, October 3). Why are there still so few women in science? *The New York Times*. Retrieved from http://www.nytimes.com/2013/10/06/magazine/why-are-there-still-so-few-women-in-science.html?_r=0

Pronin, E., Steele, C. M., & Ross, L. (2004). Identity bifurcation in response to stereotype threat: Women and mathematics. *Journal of Experimental Social Psychology, 40*(2), 152–168.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Rothbart, M., & Park, B. (1986). On the confirmability and disconfirmability of trait concepts. *Journal of Personality and Social Psychology, 50*(1), 131–142.

Rowley, S. J., Sellers, R. M., Chavous, T. M., & Smith, M. A. (1998). The relationship between racial identity and self-esteem in African American college and high school students. *Journal of Personality and Social Psychology, 74*(3), 715–724.

Rydell, R. J., & Boucher, K. L. (2010). Capitalizing on multiple social identities to prevent stereotype threat: the moderating role of self-esteem. *Personality and Social Psychology Bulletin, 36*(2), 239–250.

Rydell, R. J., McConnell, A. R., & Beilock, S. L. (2009). Multiple social identities and stereotype threat: Imbalance, accessibility, and working memory. *Journal of Personality and Social Psychology, 96*(5), 949–966.

Schmader, T. (2002). Gender identification moderates stereotype threat effects on women's math performance. *Journal of Experimental Social Psychology, 38*(2), 194–201.

Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology, 85*(3), 440–452.

Schmader, T., Johns, M., & Forbes, C. (2008). An integrated process model of stereotype threat effects on performance. *Psychological Review, 115*(2), 336–356.

Settles, I. H. (2004). When multiple identities interfere: The role of identity centrality. *Personality and Social Psychology Bulletin,* 30(4), 487–500.

Seymour, E., & Hewitt, N. M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Boulder, CO: Westview Press.

Shapiro, J. R., & Neuberg, S. L. (2007). From stereotype threat to stereotype threats: Implications of a Multi-Threat Framework for causes, moderators, mediators, consequences, and interventions. *Personality and Social Psychology Review, 11*(2), 107–130.

Shapiro, J. R., Williams, A. M., & Hambarchyan, M. (2013). Are all interventions created equal? A multi-threat approach to tailoring stereotype threat interventions. *Journal of Personality and Social Psychology, 104*(2), 277–288.

Sherman, D. K., Cohen, G. L., Nelson, L. D., Nussbaum, A. D., Bunyan, D. P., & Garcia, J. (2009). Affirmed yet unaware: Exploring the role of awareness in the process of self-affirmation. *Journal of Personality and Social Psychology, 97*(5), 745–764.

Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science, 10*(1), 80–83.

Smith, J. L., Morgan, C. L., & White, P. H. (2005). Investigating a measure of computer technology domain identification: A tool for understanding gender differences and stereotypes. *Educational and Psychological Measurement, 65*(2), 336–355.

Smith, J. L., & White, P. H. (2001). Development of the domain identification measure: A tool for investigating stereotype threat effects. *Educational and Psychological Measurement 61*, 1040–1057.

Smith, J. L., & White, P. H. (2002). An examination of implicitly activated, explicitly activated, and nullified stereotypes on mathematical performance: It's not just a woman's issue. *Sex Roles, 47*(3), 179–191.

Spears, R., Doosje, B., & Ellemers, N. (1997). Self-stereotyping in the face of threats to group status and distinctiveness: The role of group identification. *Personality and Social Psychology Bulletin, 23*(5), 538–553.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology, 35*(1), 4–28.

Steele, C. M. (1988). The psychology of self-affirmation: Sustaining the integrity of the self. In L. Berkowitz (Ed.), *Advances in Experimental Social Psychology* (Vol. 21, pp. 261–302). San Diego, CA: Academic Press.

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist, 52*(6), 613–629.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5), 797–811.

Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 34, pp. 379–440). San Diego, CA: Academic Press.

Steele, C. M., Spencer, S. J., & Lynch, M. (1993). Self-image resilience and dissonance: The role of affirmational resources. *Journal of Personality and Social Psychology, 64*(6), 885–896.

Stieger, S., & Burger, C. (2013). More complex than previously thought: New insights into the optimal administration of the initial preference task. *Self and Identity, 12*(2), 201–216.

Stieger, S., Voracek, M., & Formann, A. K. (2012). How to administer the Initial Preference Task. *European Journal of Personality, 26*(1), 63–78.

Swann, W. B. (1987). Identity negotiation: Where two roads meet. *Journal of Personality and Social Psychology, 53*(6), 1038–1051.

Tajfel, H., & Turner, J. (1986). The social identity theory of intergroup behavior. In S. Worchel & W. G. Austin (Eds.), *Psychology of intergroup relations* (pp. 7–24). Chicago: Nelson-Hall.

Taylor, S. E., & Brown, J. D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin, 103*, 193–210.

Thoman, D. B., White, P. H., Yamawaki, N., & Koishi, H. (2008). Variations of gender-math stereotype content affect women's vulnerability to stereotype threat. *Sex Roles, 58*, 702–712.

Turner, J. C., & Onorato, R. S. (1999). Social identity, personality, and the self-concept: A self-categorization perspective. In T. R. Tyler, R. M. Kramer, & O. P. John (Eds.), *The psychology of the social self* (pp. 11–46). Mahwah, NJ: Erlbaum.

von Hippel, W., von Hippel, C., Conway, L., Preacher, K. J., Schooler, J. W., Radvansky, G. A. (2005). Coping with stereotype threat: Denial as an impression management strategy. *Journal of Personality and Social Psychology, 89*(1), 22–35.

Wout, D., Danso, H., Jackson, J., & Spencer, S., J. (2008). The many faces of stereotype threat: Group- and self-threat. *Journal of Experimental Social Psychology,44*(3), 792–799.

Zhang, S., Schmader, T., & Hall, W. M. (2013). L'eggo My Ego: Reducing the gender gap in math by unlinking the self from performance. *Self and Identity 12*(4), 400–412.